



# The Taxonomic Status of the Sierra Del Agua Populations (Albacete, Spain) of *Algyroides hidalgoi* (Lacertidae) and other Confusions Derived from the Morphological Variability of the Spanish *Algyroides*

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## Research Article

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## Abstract

There are some confusions in the literature about certain features used in the identification of the Spanish *Algyroides*, including those diagnosing the population from Sierra del Agua (Albacete province) described as *Algyroides marchi niethameri*. We study a large sample of specimens of *Algyroides hidalgoi* from different areas throughout the species distribution range. The aim of this review is to clarify the character state of those features. We found that: 1) the masseteric plate, which its absence has been sometimes used as diagnostic feature of the Spanish *Algyroides* is actually present in most specimens; 2) the ventral colour of the species (from the pectoral to the proximal tail regions) is always yellow, not white, whitish, or pale gray, as it has been reported frequently; 3) the blue throat colouration, used to characterize some populations, is an artifact. Our data agree with previous preliminary data, and corroborates the synonymization of the taxon with the nominal *A. hidalgoi*. No differences between topotypic specimens of *A. m. niethameri* (Sierra del Agua, Albacete) and the rest of specimens from populations scattered along the species distribution range have been found.

**Keywords:** Spanish *Algyroides*; Morphology; Phenotypic Variability; Masseteric Scale; Ventral Colouration

## Introduction

In general descriptions of the Spanish *Algyroides*, *Algyroides hidalgoi* Boscá 1916 (see Sanchez-Vialas, et al, [1] for a taxonomical review) on field guides, encyclopedias, etc., it is not rare to find some confusions about certain features used for the identification of the species, namely 1) the presence/absence of masseteric plate, 2) ventral coloration, and 3) gular coloration. This last character (a blue throat) led to the description of the populations of the Sierra del Agua

populations as *A. marchi niethameri* [2].

## Masseteric Plate

The absence, or not prominence, of the masseteric plate has been considered and stressed in recent literature as a remarkable character to identify the Spanish *Algyroides* [3-5]. Valverde, et al. [6] however, in his description of *A. marchi* (currently a synonym of *A. hidalgoi*), reported the presence of a large masseteric scale (Figure 1D), and Palacios, et al.

[7] reported variability of this feature, although concluded that the absence was the most frequent character state. Some authors also mentioned variation in this character [3,8].

### Ventral Colouration

The colour of the ventral surface of the Spanish *Algyroides* has been many times described as white, whitish, pale gray, and yellow [8-11], although Vaverde, et al. [6] and Palacios, et al. [7] noted a yellow ventral colour.

### Throat Colouration

Buchholz, et al. [2] described the subspecies *A. marchi niethameri* based on a single male specimen preserved in ethanol and collected from Sierra del Agua. The locality was erroneously situated by Buchholz in Jaén province, but the correct site is confirmed by the location of the road: Alcaráz-Riopar villages, specified by the author, belongs to the Sierra de Alcaraz in Albacete province. This locality is situated in the northeastern part of the general distribution area of *A. hidalgoi* [12,13].

Ten characters were used to describe the holotype, but the main diagnostic features of the subspecies were an intense gular blue colour and the presence of 31 rows of dorsal scales counted in a transversal plane. With respect to the throat blue colouration, Buchholz, et al. [2] argued that, although he had studied just one specimen, the taxon was sufficiently well characterized by the highly unexpected appearance of a blue throat. He considered that all other males from the type locality (Sierra del Agua) also present blue throats. However, results showed by Palacios, et al. [7] are incongruent to the suggestions and taxonomic conclusions indicated by Buchholz, et al. [2] as they did not find these two characters among a topotypic series of specimens, concluding that the taxon could be considered as synonym of *A. marchi*. After that study, many authors have transmitted this same assertion Barbadillo, et al. [4]; Manzanares, et al. [14] Fernández-Cardenete, et al. [4,8] have mentioned that males in some populations show blue throats [8,10-12].

The examination of multiple specimens of the Spanish *Algyroides* from different localities throughout the species distribution range allowed us to properly characterize the above-mentioned diagnosing features of the species (masseteric plate, ventral colouration and gular colouration). As a result of some morphological incongruences describing the species, the aim of this revision is to contribute to clarify them.

### Methodology

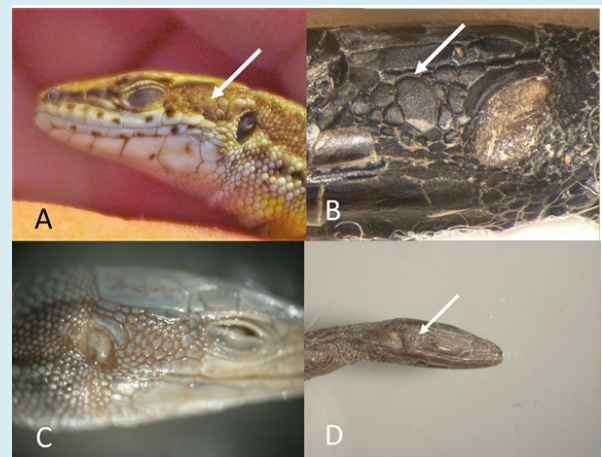
The total sample size was 247 individuals. For the study

of pholidosis and morphological characters, we examined, under stereomicroscope, a sample of 60 preserved specimens, 50 % from the type locality, Sierra del Agua (Adults = 20; 50 % males and females; 10 juveniles), and 50 % from the rest of the area (in Río Mundo and Guadalquivir upper basins; 43 % females, 57 % mails, 19 % juveniles). These specimens are deposited in the Museo Nacional de Ciencias Naturales, Madrid, Spain. Ventral colour was observed on 209 alive individuals from different areas and times (Sierra del Agua and upper basins of the Mundo, Guadalquivir, Segura and Taibilla rivers). Observations were done in different years and seasons, from 1984 to 2017 [on individuals used by first author in different studies [15-18]; including a sample of the specimens studied by Palacios, et al. [7] in Sierra del Agua. To deepen in the similarity/difference of *A. m. niethameri* with *A. hidalgoi*, we compared all the characters used in the subspecies description with topotypic specimens (from Sierra del Agua; coordinates: 38° 32' N, 2° 24' W) and also with specimens from other areas of the species' distribution (including some characters not considered by Palacios, et al. [7]).

## Results and Discussion

### Masseteric Plate

More than half of the individuals in our sample (56.7 %; n = 34) presented at least one masseteric plate (Figure 1A; see also Figure 3 of Sánchez-Vialas, et al. [1]).

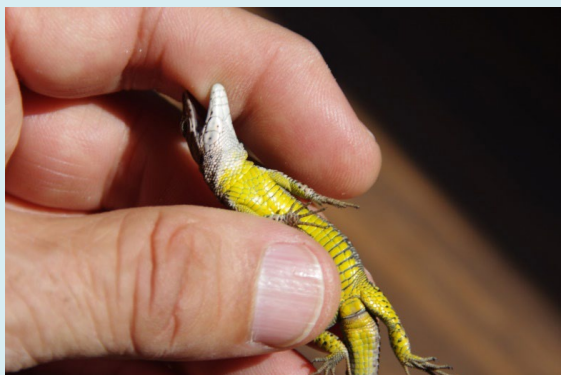


**Figure 1:** A: Masseteric plate (indicated with arrow) surrounded by smaller temporal scales in an adult male of The Spanish *Algyroides*. B: A very large masseteric plate, even with no temporal scales between the masseteric and the supratemporal scales (indicated with arrow). C: Absence of differentiated masseteric plate. D: masseteric plate present (indicated with arrow) in a paratype from the type series of the species, housed in the Biological Station of Doñana (EBD), Spain.

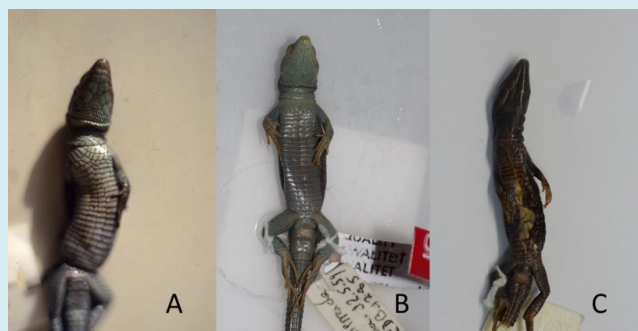
Twenty-two specimens (40%) presented masseteric plate at both sides of the head; some specimens showed a very large masseteric plate (Figure 1B). Twenty-two lizards (36.7%) had no masseteric plate on both head sides (Figure 1C). Just eight individuals (13.3 %) showed asymmetry in this character (masseteric plate in only one head side). No significant differences were found in the presence of masseteric plate between sex or age classes (Chi square:  $p > 0.1$ ).

### Ventral Colouration

All of the examined alive specimens (100 %) showed the ventral surface (from the gular zone to the proximal tail underside) yellow (the submaxilar being always white) (Figure 2).



**Figure 2:** Ventral yellow colour of the Spanish *Algyroides* from the gular region to the proximal tail. The whole belly, the cloacal scales and the inner side of the limbs are always yellow.



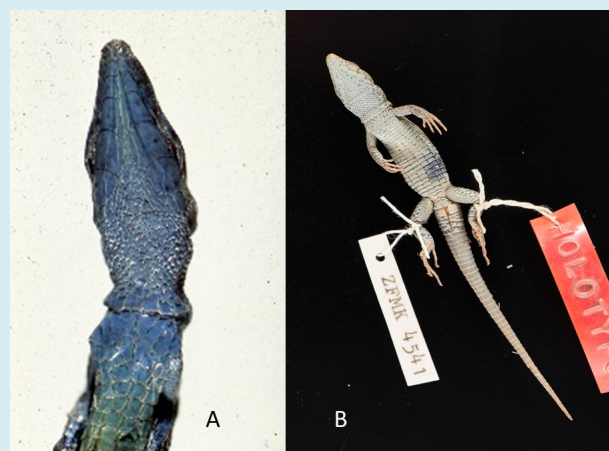
**Figure 3:** Whitish ventral colour of a specimen preserved in ethanol (A). Example of dark (B) and blackish (C) ventral colour after too much formalin in a fixation process. (Type-red label- and paratype of *Algyroides marchi* deposited in the Biological Station of Doñana; EBD, CSIC, Spain).

The yellow colour can be more or less brilliant, and its extent apparently vary seasonally [19] reaching, more or less extensively the pectoral region, the collar and the throat, as

well as the proximal tail underside. The whole venter, the cloacal scales and the inner side of the limbs, are always yellow. It is in museum collections where we can find the whitish ventral surfaces just because of the effect of the preservative ethanol [1]. After a short time of preservation in fluid, the yellow ventral colour turn whitish or pale gray (Figure 3), and bluish in some cases (see above).

### Throat Colouration and other Characters in the Population from Sierra Del Agua

Our own direct observations show that ether and chloroform (long ago, animals were sacrificed this way), and heat exposition (for instance a dead specimen drying in the sun) turn the yellow ventral colour into blue (Figure 4A; see Figure 4 of Sánchez-Vialas, et al. [1]). Ethanol (as preservative solution) can alter the pigmentation, turning it into slight bluish (Figure 4B). While blue colouration has never been found in live specimens of the Spanish *Algyroides*, some ethanol preserved specimens show different degrees of bluish colouration, both in specimens from Sierra del Agua (type locality of *A. m. niethameri*) and from the remaining populations. Buchholz, et al. [2] in his description of the subspecies, justified not to include a photograph because his specimen was preserved in alcohol, and therefore faded. The photograph of the current state of the holotype, housed in the Alexander Koenig Museum in Bonn (Figure 4B), shows a blue stein, indicating the animal was dead a certain time before being preserved. The ventral colour of some specimens can be even dark or blackish in cases of excessive formalin used in fixation processes (Figure 4B and C).



**Figure 4:** A) Blue ventral colour due to the effect of heat in a dead specimen dried in the sun (photographed in 1984). B) Ventral image of *Algyroides marchi niethameri* holotype, showing a slight bluish ventral colour. The darker stain suggests the specimen was dead a certain time before being preserved in alcohol (photograph D. Rödder).



In respect of other features described for the Sierra del Agua population, we found no differences compared to specimens from other populations: 1) loreal and preocular scales were similar; 2) four individuals (13%) from each area, Sierra del Agua and the remaining populations, present at least one divided frenocular scale, which was used to differentiate *A. m. niethameri*, according to its description; 3) a small triangular scale inserted between the third and fourth supralabial scales, mentioned by Buchholz, et al. [2] appears in 8 specimens from Sierra del Agua, and in 6 specimens of populations from the rest of the distribution. Moreover, there can be a higher number of these small scales, and they can be inserted between different supralabial scales (Figure 5).



**Figure 5:** Small scales inserted between third-fourth and fourth-fifth supralabial scales from the Mundo river upper basin.

With our studied sample, we corroborate the absence of significant differences in the features studied by Palacios, et al. [7] between Sierra del Agua and the general range locations (and seasons). The data presented here increase the reported ranges in the pholidosis variability for *A. hidalgoi*. The maximum number of rows of dorsal scales counted in a transversal plane in the center of the body includes in our sample two individuals with 32 rows of scales, one from Sierra del Agua and one from the rest of the distribution. Palacios, et al. [7] indicated that they found no more than 30 rows of scales, over the general distribution area; one less than the 31 reported by Buchholz, et al. [2]. The trunk scales in the Spanish *Algyroides* are differentiated into two types, large keeled dorsal scales and small and smooth lateral scales [1,6]. The number of lateral scales decreases rapidly from the first rows at the axilla level, towards the center of the body (as the scales sizes increase), with differences up to 17 scales. 2).

The minimum number of femoral pores was represented by one specimen with 9 pores instead of the

11 pores reported previously, although it is frequent to find undeveloped femoral pores in distal position (28 % of the total sample; with similar number in Sierra del Agua and the general range areas).

### Concluding Remarks

The presence of a masseteric plate in *Algyroides hidalgoi* including the Sierra del Agua populations is common; and when present, it could be variably found at one side or in both sides of the head. Lack of this scale cannot be used as diagnostic character for the species identification.

The ventral colouration of *A. hidalgoi* is yellow, in spite of possible variations of the colour extension on the pectoral-gular and tail underside zones.

The blue colour that diagnosed *A. m. niethameri* is an artifact. As stated by Palacios, et al. [7] we support the invalidity of the subspecies. Our revision of this character provides an explanation for the blue colour found by Buchholz, et al. [2] in agreement with Sánchez-Vialas, et al. [1].

No morphological differences exist between topotypic specimens of *A. m. niethameri* [2] (Sierra del Agua, Albacete) and specimens from other populations from the distribution range of *A. hidalgoi*. The current knowledge of the species distribution shows that the type locality of *A. m. niethameri* is within the species distribution [20,21]. Lack of morphological variation geographically structured is consistent with the apparent gene flow among populations of *A. hidalgoi* [21,22].

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